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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/710,947

08/13/2004

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EXAMINER

HE, AMY

ART UNIT

PAPER NUMBER

2831

NOTIFICATION DATE

DELIVERY MODE

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ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PTOCommunications@hwdpatents.com
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Office Action Summary	Application No. 10/710,947	Applicant(s) CHUDZIK ET AL.	
	Examiner AMY HE	Art Unit 2831	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16-19 is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-14 and 20 is/are rejected.
- 7) ☒ Claim(s) 10 and 15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 August 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-3, 5-7, 9, 11,12, 14 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (U. S. Patent No. 6, 759,255).

As for claims 1, 3, 9, 11, 14 and 20, Xu discloses a method/system (in Figure 1; abstract) for determining characteristic of a material on a substrate, comprising:

depositing the material(col. 6, lines 15-16) on the substrate using a first value of a growth metric (a first time);

depositing an amount of charge on a surface of the material (step 12);

repeatedly measuring a surface voltage of the material until an onset of tunneling to provide a V_{tunnel} value (step 18);

repeating the above steps for different values of the growth metric (repeated at a second time, col. 8, lines 7-14; Figure 8 with E_{tunnel} plotted against time); and

comparing the V_{tunnel} values (V_{tunnel} values for the two different type of metal contaminations by two different annealing process at two different time/growth metric,

col. 8, line 7-20), or comparing an E_{tunnel} value (see E_{tunnel} values as shown in Figures 6-10; col. 8, lines 24-30), for different values of the growth metric (time) to provide a measure of the characteristic of the material on the substrate.

Still referring to claims 1, 3, 9, 11, 14 and 20, Xu does not specifically disclose that the characteristic of the material determined is the continuity of the material on the substrate, and/or the growth mode of the material.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Xu to determine the continuity and/or the growth mode/thickness of the material on the substrate, so as to detect the interested characteristics of the dielectric material on the substrate using the less expensive and nondestructive testing method to rapidly and accurately measure the semiconductor topography (col. 1, line 43-col. 2, line 43).

As for claims 2 and 12, Xu does not specifically disclose determining a transition between a linear region and a non-linear region, wherein the linear region corresponds to layer-to-layer growth of the material and the nonlinear region corresponds to islanded growth of the material on the substrate. However, a person of ordinary skill in the art would recognize a transition between a linear region and a non-linear region on the plot of the V_{tunnel} / E_{tunnel} values as shown in Xu (E_{tunnel} values in Figs. 6-10).

As for claim 5, Xu discloses depositing a fixed amount of charge on the material (col. 7, lines 5-15).

As for claim 6, Xu discloses that the method is nondestructive (col. 7, lines 15-28; abstract) and can be used in-line (Figure 5).

As for claim 7, Xu discloses that the material is a high-k dielectric material (col. 6, line 26).

2. Claims 4, 8 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Xu et al. (U. S. Patent No. 6, 759,255), in view of Jursich et al. (U. S. Pub. No. 2005/0003662).

As for claim 4, Xu discloses that the material is deposited on the substrate using CVD (col. 6, lines 15-25). Xu does not specifically disclose that the material is deposited on the substrate using Atomic Layer Deposition (ALD).

Jursich et al. discloses that in thin film deposition for semiconductor fabrication, ALD is more desirable over CVD (see [0009]).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Xu to use Atomic Layer Deposition (ALD), as taught by Jursich et al., for depositing thinner and more uniform layers in the semiconductor devices ([0009]).

As for claims 8 and 13, Xu does not specifically disclose identifying optimum growth conditions for layer-by-layer deposition of the material on the substrate.

Jursich et al. discloses setting optimum growth conditions ([0044], [0045], [0046], [0047] and [0048]).

A person of ordinary skill in the art would find it obvious to modify Xu to identify optimum growth conditions for the deposition of the material, as taught by Jursich et al.

for the purpose of depositing the dielectric material on the substrate more uniformly ([0044], [0045], [0046], [0047] and [0048]) in an ALD process.

Allowable Subject Matter

3. Claims 16-19 are allowed.
4. Claims 10 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
5. The following is a statement of reasons for the indication of allowable subject matter:

Claims 10 and 15 are allowable because the prior art does not disclose or make obvious in combination a method for determining continuity of a material on a substrate, comprising determining a growth mode of the material on the substrate by comparing a first derivative of a $V_{\text{tunnel}}/E_{\text{tunnel}}$ per growth metric curve versus the growth metric; and examining a linearity of results of the comparison, wherein a linear region corresponds to a layer-by-layer growth mode and the non-linear region corresponds to an islanded growth mode of the material.

Claims 16-19 are allowable because the prior art does not disclose or make obvious in combination a method for determining a growth mode of a material on a substrate, comprising comparing a first derivative of a V_{tunnel} per growth metric curve versus the growth metric to determine the growth mode of the material on the substrate.

Response to Arguments

6. Applicant's arguments regarding claims 1-3, 9, 11, 12, 14 and 20 have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

As for claims 1, 3, 9, 11, 14 and 20, Xu does disclose comparing the V_{tunnel} values (V_{tunnel} values for the two different type of metal contaminations by two different annealing process at two different time/growth metric, col. 8, line 7-20), or comparing an E_{tunnel} value (see E_{tunnel} values as shown in Figures 6-10; col. 8, lines 24-30), for different values of the growth metric (time) to provide a measure of the characteristic of the material on the substrate, wherein the growth metric used is time.

Although the characteristic of the material determined in Xu is metal contamination, the same method of measuring the V_{tunnel}/E_{tunnel} values can be used by a person of ordinary skill in the art to derive other desired characteristics, including the continuity/growth mode (e.g., if there is no metal contamination found in the material, then the material can be considered as a continuous piece of material with no

other material growth) of the material on the substrate, so as to detect other interested characteristics of the dielectric material on the substrate using the less expensive and nondestructive testing method to rapidly and accurately measure the semiconductor topography (col. 1, line 43-col. 2, line 43).

In response to applicant's argument regarding claims 2 and 12, the examiner asserts that any person of ordinary skill in the art would recognize a transition between a linear region and a non-linear region on the plots of the $V_{\text{tunnel}}/E_{\text{tunnel}}$ values by looking at the plots of the $V_{\text{tunnel}}/E_{\text{tunnel}}$ values in Xu.

7. Applicant's arguments with respect to claims 10, 15 and 16-19 have been fully considered and are persuasive. Accordingly, claims 16-19 are allowed, and claims 10 and 15 are objected to as being dependent upon a rejected base claim.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMY HE whose telephone number is (571)272-2230.

The examiner can normally be reached on 9:30am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on 571-272-2245. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Diego Gutierrez/
Supervisory Patent Examiner, Art Unit 2831

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